

22762

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
3 January 2002 (03.01.2002)

PCT

(10) International Publication Number
WO 02/00390 A1(51) International Patent Classification⁷: **B23Q 39/02**

(74) Agent: AWAPATENT AB; Box 5117, S-200 71 Malmö (SE).

(21) International Application Number: PCT/SE01/01481

(22) International Filing Date: 28 June 2001 (28.06.2001)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data:
0002425-7 28 June 2000 (28.06.2000) SE(71) Applicant (for all designated States except US): **MODIG MACHINE TOOL AB** [SE/SE]; Box 20, S-570 80 Virserum (SE).

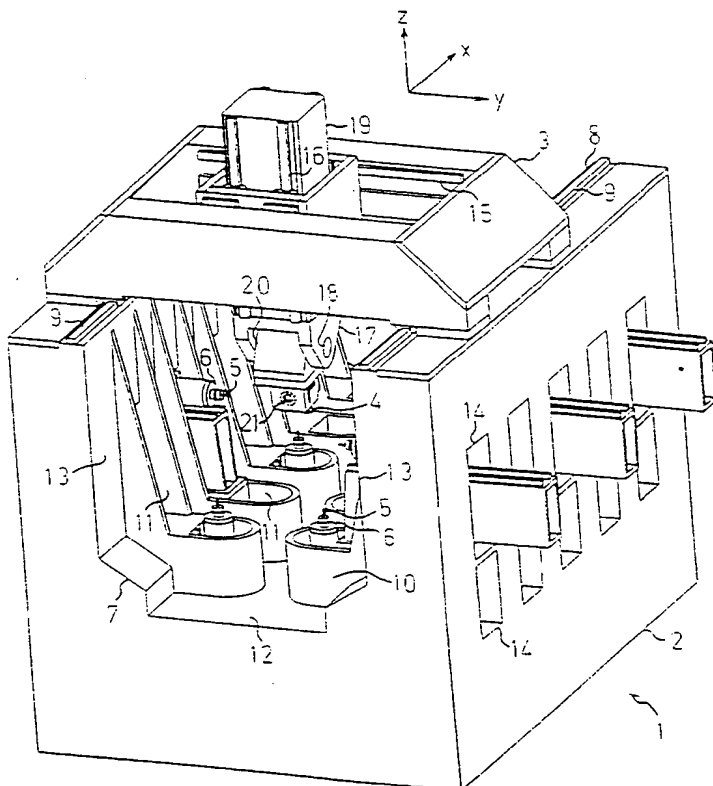
(72) Inventor; and

(75) Inventor/Applicant (for US only): **MODIG, Percy** [SE/SE]; Evagatan 10, S-570 80 Virserum (SE).(81) Designated States (*national*): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

No US Equip Found

[Continued on next page]

(54) Title: MULTI OPERATION MACHINE WITH AN U-SHAPED FRAME WITH SEVERAL APERTURES



(57) Abstract: A multi-operation machine (1) comprises a machine frame (2), a holder (3), which is arranged to hold a workpiece (4) and to move said workpiece during machining thereof along three axes constituting a first (x), a second (y) and a third (z) axis of a three-dimensional co-ordinate system, and at least two tools (5), which are each fitted to a support (6) and which are arranged to machine the workpiece (4) in sequence while this is being displaced by means of the holder (3). Each support (6) is arranged to assume a fixed position relative to the machine frame (2) while the workpiece (4) is being machined by the associated tool (5). The machine frame (2) has the shape of an upwardly open U-shaped channel (7) over which the support (3) extends like an overhead crane and which has a bottom portion (10) in which the supports (6) are arranged.

WO 02/00390 A1

Multi operation Machine with an U-shaped frame with several apertures.

Field of the Invention

The present invention relates to a multi-operation machine, comprising a machine frame, a holder, which is arranged to hold a workpiece and to move said workpiece
5 during machining thereof along three axes constituting a first, a second and a third axis of a three-dimensional coordinate system, and at least two tools, which each are fitted to a support and which are arranged to machine the workpiece in sequence while this is being displaced by
10 means of the holder, each support being arranged to assume a fixed position relative to the machine frame while the workpiece is being machined by the associated tool.

Background Art

15 US 5,486,151 discloses a multi-operation machine according to the introduction. This machine has two prominent features which distinguish it from prior-art machines of this type. First, in this machine the supports consist of two spindles, which are arranged to
20 drive tools for machining a workpiece that are interchangeable by means of tool changers. The advantage of this arrangement is that the time required for a tool change in one of the spindles can be used to machine the workpiece by means of the tool on the other spindle.
25 Second, in this machine the spindles are intended to assume a fixed position relative to the machine frame during machining of the workpiece. The advantage here is that it is easier to control the machine since it is always the same machine element, namely the holder, that
30 is moved during machining.

A disadvantage of the prior-art machine is that the machining opportunities offered by these two spindles are not optimal, since it is not possible to achieve an ade-

located outside said machining zone. The advantage of this solution is that the openings create even more space for supports in the bottom portion of the channel.

Furthermore, the bottom portion of the channel preferably comprises a horizontal bottom wall and two vertical side walls rising parallel to each other on both sides of the bottom wall, the openings being formed partly in said bottom wall and partly in said side walls. The advantage of this is that it is possible to provide, in an extremely simple way, supports for both horizontally and vertically oriented tools.

Moreover, the openings are preferably tunnel-shaped and the supports comprise brackets for mounting therein. The advantage of this is that the assembly and disassembly of the supports is thus considerably facilitated.

In addition, the openings preferably have apertures on the outside of the channel and the supports are exchangeable from the outside of the channel through these apertures. The advantage of this solution is that the accessibility of the supports is considerably improved and that it is possible, if desired, to assemble or disassemble a support during operation of the machine.

The third axis is preferably vertical and the holder is arranged to rotate the workpiece about this axis. In addition, the holder is preferably arranged to rotate the workpiece about a horizontal pivot shaft, which is rotatable about the vertical axis and parallel to a plane through said first and second axes. Moreover, the holder is preferably arranged to rotate the workpiece about a further pivot shaft, which is perpendicular to said vertical axis and said horizontal pivot shaft. The advantages of these further axes of movement are that each of them improves the possibilities of machining the workpiece.

Preferably, at least one of the supports comprises a tool changer, which is arranged to switch, in said

arranged to assume a fixed position relative to the machine frame 2 while the workpiece 4 is being machined by the tool 5 associated with the operating spindle 6.

As shown, the machine frame 2 has the shape of a upwardly (in the z-direction) open U-shaped channel 7 over which the support 3 extends like an overhead crane, i.e. it bridges the upper opening 8 of the channel 7, rails 9 extending in the x-direction and intended for the displacement of the holder 3 in this direction encompassing said opening 8. In addition, the channel 7 has a bottom portion 10, in which the spindles 6 are arranged.

More particularly, the spindles 6 are each arranged in one of a plurality of openings 11 in the bottom portion 10 of the channel 7. This bottom portion 10 comprises a horizontal bottom wall 12 and two vertical side walls 13 rising parallel to each other on both sides of the bottom wall 12. The openings 11 are formed partly in said bottom wall 12 and partly in said side walls 13, said openings 11 being tunnel-shaped and having apertures 14 which are positioned on the outside of the machine frame 2 or the channel 7 and through which the spindles 6 are exchangeable.

In addition to the three axes of displacement x, y and z, which are defined by the rails 9 mentioned above and by horizontal rails 15 extending in the x-direction and vertical rails 16 extending in the z-direction, the holder 3 also has three axes of rotation. The first axis of rotation is defined by the axis z and extends through the centre of a central column 19 of the holder 3, which column is vertically displaceable by means of the rails 16, and allows a fork 17 mounted on the column 19 and associated with the holder 3 to be rotated about the axis z. The second one of these axes of rotation is horizontal, i.e. extends in the x-y plane, and extends through the centre of a journal 18 carried on the fork 17, a further holder element 20 being pivotally carried on said journal 18. The third one of these axes of rotation ex-

CLAIMS

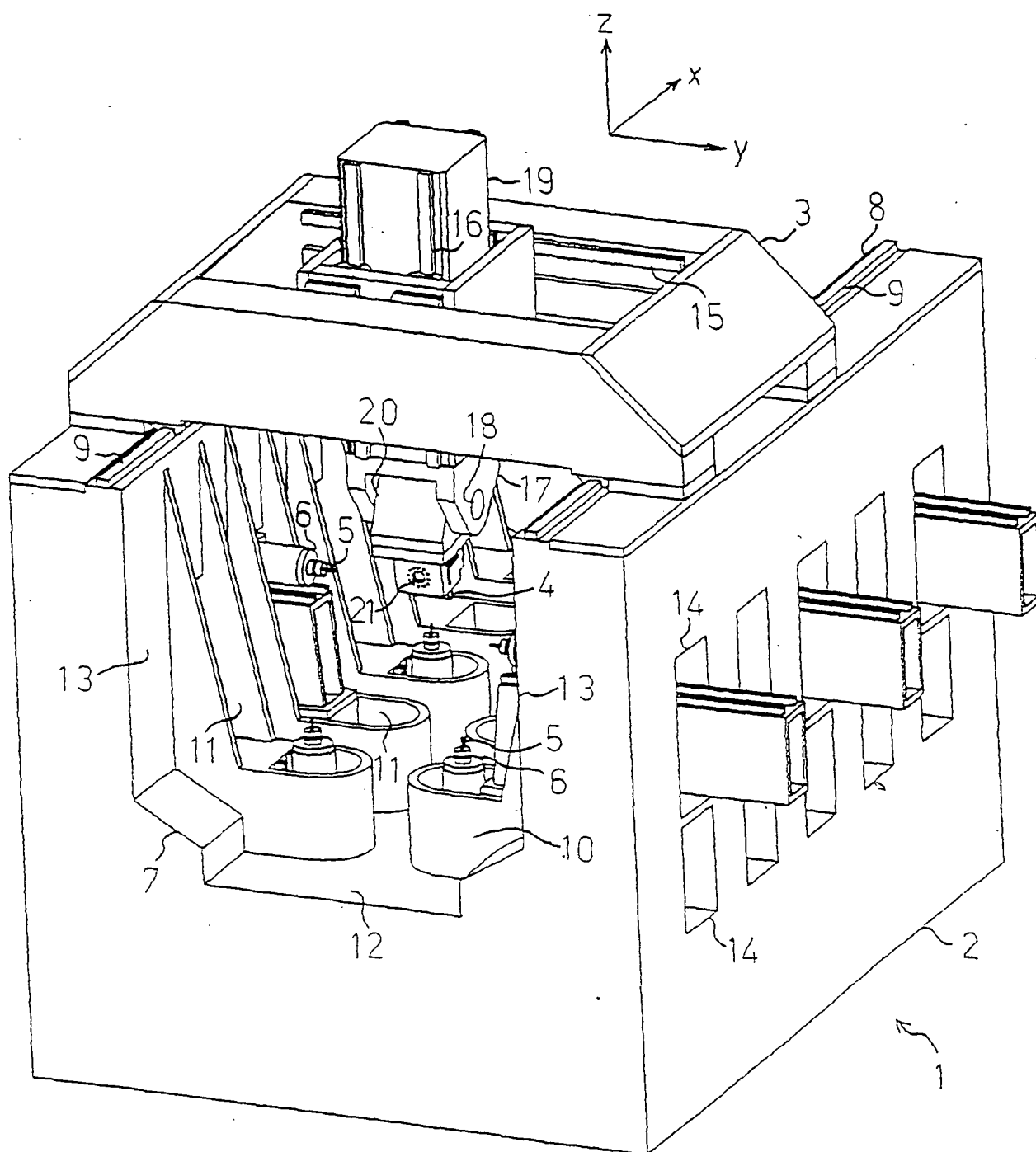
1. A multi-operation machine, comprising a machine
5 frame (2), a holder (3), which is arranged to hold a
workpiece (4) and to move said workpiece during machining
thereof along three axes constituting a first (x), a
second (y) and a third (z) axis of a three-dimensional
coordinate system, and at least two tools (5), which are
10 each fitted to a support (6) and which are arranged to
machine the workpiece (4) in sequence while this is being
moved by means of the holder (3), each support (6) being
arranged to assume a fixed position relative to the ma-
chine frame (2) while the workpiece (4) is being machined
15 by the associated tool (5), c h a r a c t e r i s e d in
that the machine frame (2) has the shape of an upwardly
open U-shaped channel (7) over which the holder (3) ex-
tends like an overhead crane and which has a bottom
portion (10) in which the supports (6) are arranged.

20 2. A machine according to claim 1, c h a r a c -
t e r i s e d in that the supports (6) are each arranged
in one of a plurality of openings (11) in the bottom por-
tion (10) of the channel (7) and that they are displace-
able between a working position, in which the associated
25 tool (5) is located within a machining zone for machining
the workpiece (4), and a resting position, in which the
associated tool (5) is located outside said machining
zone.

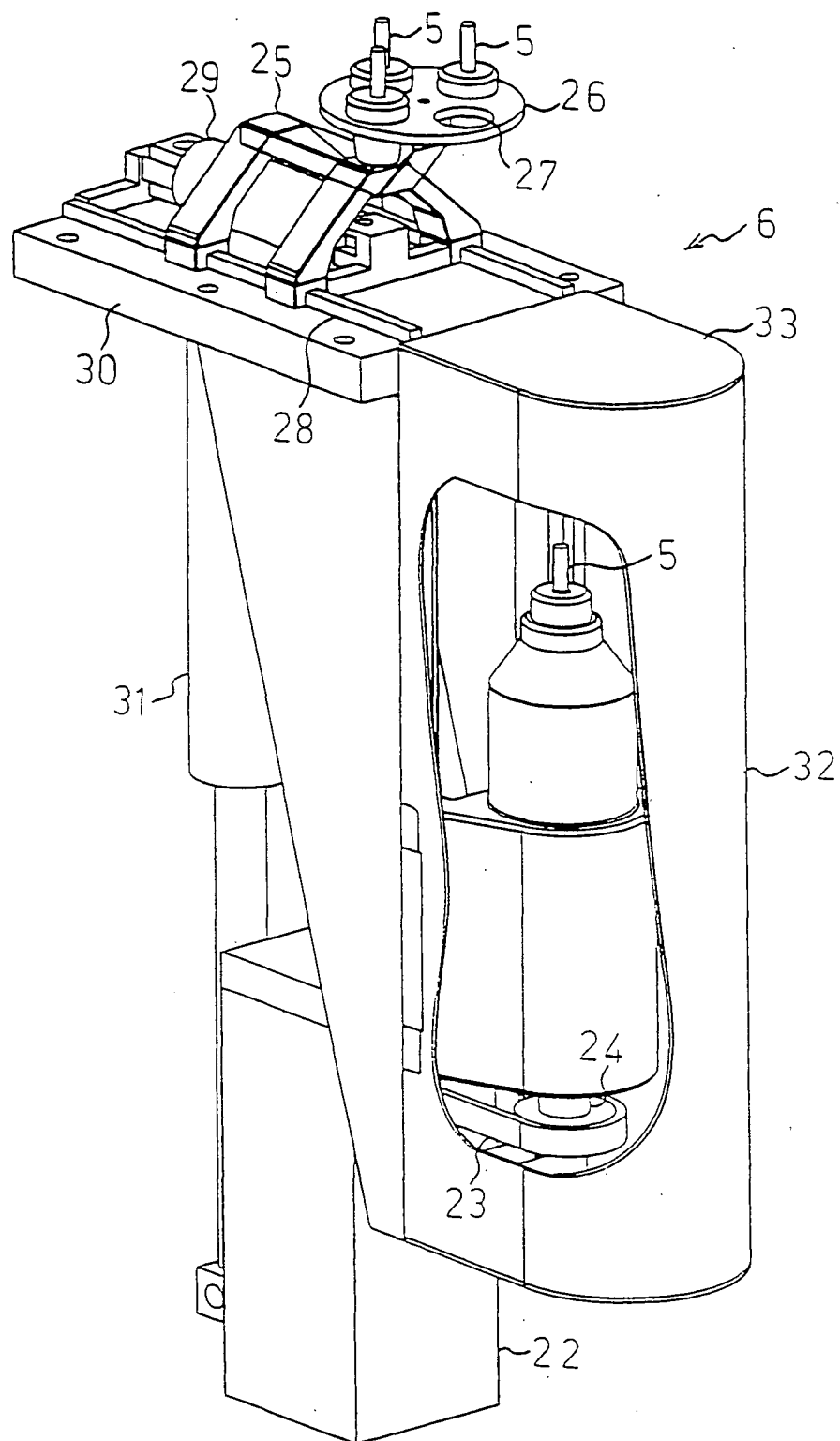
3. A machine according to claim 2, c h a r a c -
30 t e r i s e d in that the bottom portion (10) of the
channel (7) comprises a horizontal bottom wall (12) and
two vertical side walls (13) rising parallel to each
other on both sides of the bottom wall (12), the openings
(11) being formed partly in said bottom wall (12) and
35 partly in said side walls (13).

4. A machine according to claim 2 or 3, c h a r -
a c t e r i s e d in that the openings (11) are tunnel-

1 / 3

FIG 1

3 / 3

FIG 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 01/01481

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5486151 A (KLAUS BERGMANN ET AL), 23 January 1996 (23.01.96), figure 1, abstract -----	1-11